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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/585,094	07/19/2006	Alain Penicaud	BJS-5006-9	5765

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EXAMINER	
CHAN, HENG M	

ART UNIT	PAPER NUMBER
1793	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/585,094	PENICAUD ET AL.	
	Examiner	Art Unit	
	HENG M. CHAN	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 April 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12 and 16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12 and 16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status of Application

Applicant's amendments and arguments/remarks filed 04/27/2009 have been acknowledged. Claims 13-15 has been cancelled and claim 16 has been added. Claims 1-12 have been amended. Claims 1-12 and 16 are currently pending.

Claim Objections

1. Claim 16 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 1. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

2. Claims 1, 2, 5, 7, and 16 are rejected under 35 U.S.C. 102(a) as being anticipated by "Spontaneous dissolution of a single-wall carbon nanotube salt" by Petit et al. published in JACS communications on the web on 12/10/2004.

3. Regarding claims 1, 2, 5, 7, and 16, Petit et al. teach a method of dissolving carbon nanotubes, comprising:

(i) Providing reduced, negatively charged nanotubes, e.g. single-wall carbon nanotubes (SWNTs), with positive counterions, i.e. alkali metals, by reducing carbon nanotubes; and

(ii) adding a polar organic solvent, e.g. sulfolane, to the negatively charged nanotubes of step (i), resulting in a dissolved phase of negatively charged nanotubes with positive counterions in the solvent (p8, left, lines 15-20 and 26-30; Figures 1 and 4).

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 2, 9, 11, and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,695,734 to Ikazaki et al.

6. Regarding claims 1, 2, and 16, Ikazaki et al. teach a method of dissolving carbon nanotubes, comprising:

(i) Providing reduced, negatively charged nanotubes with positive counterions, e.g. lithium or sodium, by reducing carbon nanotubes; and

(ii) adding a polar organic solvent, e.g. tetrahydrofuran containing naphthalene, to the negatively charged nanotubes of step (i), resulting in a dissolved phase of negatively charged nanotubes with positive counterions in the solvent (column 2, lines 44-48).

Regarding claim 9, Ikazaki et al. define carbon nanotubes as hollow graphite tubules having a diameter of generally several to several tens nanometers (column1, lines 8-10).

Regarding claim 11, Ikazaki et al. teach a step of purifying the nanotubes, for example, by a solid-liquid separation such as by filtration, the carbon nanotubes may be isolated (column 2, lines 65-67).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. **Claims 1-5, 7, 11, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Controlling the electronic properties of single-wall carbon nanotubes by chemical doping" by Jouguelet et al. published in *Chemical Physics Letters* 318 (2000) 561-564, in view of Petit et al.**

9. Regarding claims 1, 2, 5, 7, and 16, Jouguelet et al. teach a method of dissolving carbon nanotubes, comprising:

(i) Providing reduced, negatively charged nanotubes, e.g. single-wall carbon nanotubes (SWNTs), with positive counterions, i.e. Li^+, by reducing carbon nanotubes (p561, 2nd parag. of introduction; p562, 1st parag.; p563, 1st parag.).

Jouguelet et al. do not expressly teach (ii) adding a polar organic solvent, e.g. THF, to the negatively charged nanotubes of step (i), resulting in a dissolved phase of negatively charged nanotubes with positive counterions in the solvent.

Petit et al. teach a method of dissolving carbon nanotubes, comprising:
(i) Providing reduced, negatively charged nanotubes, e.g. single-wall carbon nanotubes (SWNTs), with positive counterions, i.e. alkali metals, by reducing carbon nanotubes; and
(ii) adding a polar organic solvent, e.g. sulfolane, to the negatively charged nanotubes of step (i), resulting in a dissolved phase of negatively charged nanotubes with positive counterions in the solvent (p8, left, lines 15-20 and 26-30; Figures 1 and 4).

Therefore, it would have been obvious to one of ordinary skill in the art at time of invention to have modified the method of Jouguelet et al. by adding a polar organic solvent to the negatively charged nanotubes of step (i), resulting in a dissolved phase of negatively charged nanotubes with positive counterions in the solvent, motivated by the fact that Petit et al. teach that homogeneous, stable, and spontaneously formed solutions of unmodified SWNTs should be a welcome starting material for obtaining composites and conducting/antistatic coatings with improved mechanical properties and that these SWNT solutions provide a possibility to selectively and stoichiometrically functionalize the nanotube walls (from page 9, left, 2nd parag. to right 1st parag.).

Regarding claims 3-4, Jouguelet et al. teach that in a glass apparatus sealed under high vacuum (i.e. under anaerobic condition), a sample of carbon single-wall nanotubes (SWNTs) was exposed to molecules that are radical-anions of naphthalene,

benzophenone, fluorenone, anthraquinone and benzoquinone, with Li^+ as a counter ion (p562, 1st parag.). Thus, the molecules were added as salts of a cation of an alkali metal ion (i.e. lithium) and a polyaromatic compound (i.e. naphthalene, benzophenone, fluorenone, anthraquinone, or benzoquinone).

10. **Claims 8 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jouguelet et al. and Petit et al. as applied to claim 1 above, in view of WO 2004/046031 by Ajayan et al.**

Regarding claims 8 and 12, Jouguelet et al. do not expressly teach that the nanotubes are multi-walled nanotubes or that the method further comprises a step of functionalizing the surface or the ends of the nanotubes.

Ajayan et al. disclose a process of producing negatively charged single and multiwalled nanotubes (i.e. anions or carbanions on the surface of underivatized CNTs) using, for example, radical ionic initiators such as sodium naphthalenide ([0002] and [0020]). Ajayan et al. teach attaching functional groups to the surface of the CNTs to, for example, increase the derivatized CNT solubility in organic materials, thus making the derivatized, well-dispersed CNTs amenable to incorporation into a matrix ([0019]).

It would have been obvious to one of ordinary skill in the art at time of invention to have produced negatively charged multi-walled nanotubes and functionalize the single or multi-walled nanotubes as suggested by Ajayan et al. in the method of Jouguelet et al., motivated by the fact that the skilled artisan would have appreciated using not only the single walled nanotubes but also the multi-walled nanotubes to

produce negatively charged nanotubes so that they can be dispersed in organic materials and functionalized on the surface to serve various purposes including nanometer-scale electronics ([0006-9]).

11. Claims 6 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Petit et al. as applied above, in view of "First-principles simulations of endohedral bromine in BC_3 nanotubes" by Mintmire et al. published in *J. Phys. Chem. B* 1998, 102, 1568-1570.

12. Regarding claims 6 and 10, Petit et al. do not expressly teach that the carbon nanotubes contain boron atoms in place of carbon atoms or that the carbon nanotubes contain molecules, salts, or metal elements inside their hollow interior.

Mintmire et al. investigate the stability of composite systems consisting of BC_3 nanotubes with a linear chain of bromine atoms inside (abstract).

It would have been obvious to one of ordinary skill in the art at time of invention to have used a carbon nanotube that contains boron atoms in place of carbon atoms or carbon nanotubes that contain molecules such as bromine inside the hollow interior in the method provided by Petit et al., motivated by the fact that the skilled artisan would have appreciated using the endohedral bromine BC_3 nanotubes which would result in a large conductivity due to the introduction of halogen into the nanotubes (p1568, right, 1st parag.) in order to enhance the conductivity of composites and conducting/antistatic coatings that could be obtained from the nanotubes dissolved by the method of Petit et al.

Response to Arguments

13. Applicant's arguments with respect to claims 1-12 have been considered but are moot in view of the new ground(s) of rejection.

14. Applicant argues that Jouguelet et al. teach a method of producing reduced (i.e. doped) carbon nanotubes, but fails to teach the further method of the claimed invention relating to dissolving the reduced carbon nanotubes in a polar organic solvent to produce a dissolved phoase of negatively charged nanotubes in the stated solvent on p9 of the remarks.

In response, the Examiner has provided a reference by Petit et al. that teach both the reduction and the dissolving steps (see 102a rejection above), another reference by Ikazaki et al. that also teach both steps (see 102b rejection above), and a combination of references of Jouguelet et al. in view of Petit et al. where the deficiency of Jouguelet et al. is cured by Petit et al. who indicate that homogeneous, stable, and spontaneously formed solutions of unmodified SWNTs should be a welcome starting material for obtaining composites and conducting/antistatic coatings with improved mechanical properties and that these SWNT solutions provide a possibility to selectively and stoichiometrically functionalize the nanotube walls (from page 9, left, 2nd parag. to right 1st parag.).

Conclusion

15. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to HENG M. CHAN whose telephone number is (571)270-5859. The examiner can normally be reached on Monday to Friday, 8:00 am EST to 5:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jerry Lorengo can be reached on (571)272-1233. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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